HONEYWELL

MAINTENANCE AND REPAIR

R7161C VERSATRONIK*
HIGH LIMIT CUT-OFF

SPECIFICATIONS

MODEL: R7161C Versa-Guard High Limit Cutoff.

SIGNAL SOURCE: DC millivolts.

VOLTAGE AND FREQUENCY: 120/208/220/240v, 60 cps; voltage is field selectable. Satisfactory operation is provided between 85 percent and 110 percent of rated voltage. If unit is supplied from a constant voltage transformer, use a harmonic neutralized type only.

INDICATION ACCURACY: ± 1 percent of full scale.

CONTROL POINT REPEATABILITY: ±60 microvolts.

AMBIENT TEMPERATURE: 40 to 120 F.

SWITCHING ACTION: Spdt, non-overlapping.

RELAY DIFFERENTIAL: 40-120 microvolts.

CONTACT RATINGS: 50 va at 120, 208, 220, vac with inrush not to exceed 500 va. 50 va at with inrush not to exceed 250 va. 5 amp resistive load.

POWER CONSUMPTION: 5 watts nominal.

WHEN ORDERING:

Specify—
1. Model number.
2. Voltage and frequency.
3. Range and type of thermocouple to be used.

Order from—
1. Local Honeywell Branch Office, or
2. Honeywell Inc.
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422
   (In Canada—Honeywell Controls Limited
   Vanderhoof Avenue, Leaside
   Toronto 17, Ontario

ELECTRONIC OPERATION

The R7161C is a solid state, high limit controller providing on-off control action. It consists of two separate independent circuits; the meter indicating circuit and the relay control circuit. A dc mv input is provided by a suitable thermocouple which senses the actual process temperature. The input to both the indicating circuit and the relay control circuit is derived from the mv thermocouple input.

The signal to the indicating circuit is passed through a portion of a dc bridge network and fed to the chopper. The chopper modulated signal is sent through two stages of amplification, then back to the chopper for demodulation. The resultant pulsating dc waveform is sent to the meter where the average voltage is shown as degrees of temperature.

A dc voltage from the bridge network and the thermocouple input, bucking one another, determine the input to the relay control amplifier. The level of the dc from the bridge determines the setpoint of the controller. The signal first goes to the chopper for modulation and then through three stages of amplification. It is sent back to the chopper, demodulated, and the pulsating dc is then fed to the trigger amplifier. The trigger amplifier is designed to control the relay according to the chopper demodulator output. With the trigger amplifier receiving 0 (Null) or positive pulses the relay drops out. Negative pulses pass a square wave to the transformer (T2). In the secondary circuit this power is rectified and applied to the relay as dc causing it to pull in. A 500 uf cap in parallel with relay coil prevents relay action during momentary line disturbance.

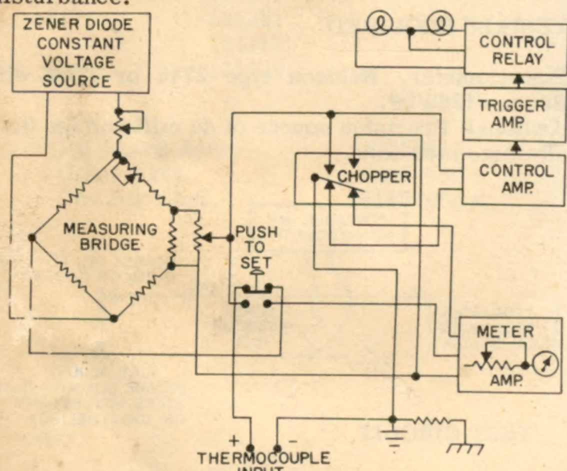


Fig. 1—Block Diagram, R7161C.

8-66
R.B.
*Trademark

Form Number 75-5938
Apparatus Controls Div.

CONVERTING TO A DIFFERENT RANGE

Any R7161C may be converted to any other temperature or millivolt range by changing the range card, scale plate and using an appropriate "type" thermocouple. When converting to another range, the R7161C must be recalibrated.

New range cards may either be purchased from Honeywell by specific part numbers or made up locally by substituting resistors on the range card. The following tabulation lists the resistance values of the standard R7161C ranges.

Type of Input	Range in Degrees	Range Card #122544__						Scaleplate Part No. 121173__	Door Assy. No. 120100
		r1 (2% tol.)	r2 (2% tol.)	r3 (2% tol.)	r4 (1% tol.)	r5 (5% tol.)	To Order, Include Suffix Letters		
J	0 to 400 F	6.65	4.41	2.82	64.9	3.9M	R	AA	CK
	0 to 800 F	6.65	10	2.82	255	2.2M	A	A	BA
	0 to 1200 F	6.65	20	2.82	453	1.5M	B	B	BB
	0 to 600 C	6.65	20	2.82	453	1.5M	B	N	BN
	0 to 1400 F	6.65	33	2.82	576	1.2M	BP	BB	ED
	0 to 750 C	6.65	33	2.82	576	1.2M	BP	BC	EF
	0 to 1600 F	6.65	47	2.86	665	1.2M	C	C	BC
	100 to 700 F	6.65	7.5	3.57	174	3M	V	AU	CT
K	0 to 1200 F	5.28	13.2	2.33	3[illegible]9	2M	S	AC	CM
	0 to 2000 F	5.28	33	2.33	5[illegible]6	1.2M	D	D	BD
	0 to 1000 C	5.28	33	2.33	576	1.2M	D	Q	BQ
	0 to 2400 F	5.28	56	2.33	715	1.2M	E	E	BE
R	0 to 3000 F	0.78	8.25	0.39	191	3M	F	F	BF
	0 to 1600 C	0.78	8.25	0.39	1[illegible]1	3M	F	S	BS
S	0 to 3000 F	0.78	6.98	0.39	162	3M	G	G	BG

Range Card Resistance Values for Various Ranges.

CALIBRATION

The R7161C is completely calibrated at the factory for 60 cycle operation and usually requires only routine start-up procedure at time of installation. However, field recalibration is absolutely essential for:

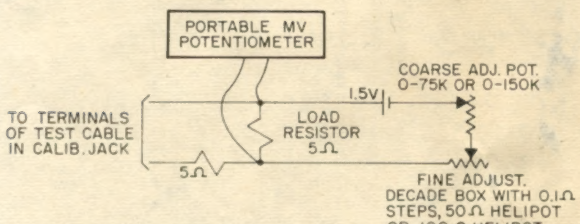
1. Use with a 50 cycle power supply.
2. Range change.
3. Any internal component change.

Recalibration is also sometimes useful, but not always necessary, as a trouble shooting step to help localize a malfunction.

NOTE: Recalibration of this device should only be attempted by qualified instrument technicians.

MATERIALS REQUIRED

-Potentiometer, Rubicon type 2745 or 2714, or Brown #126W2P.
-(Optional) Precision source of dc millivoltage (for alternate method).



TEST CIRCUIT

-Test cable, Honeywell #117053, supplied with each R7161C.
-Screwdriver, 1/8" blade, shaft taped to prevent grounding to case.
-Handbook or tables of temperature - millivoltage equivalents for specific type of thermocouple used.
-DC Millivoltmeter, zero center.
-Standard thermometer for measuring case temperature.

It is recommended that the calibrating potentiometers be adjusted in the order given (P1, P2, P3) and that the entire procedure be rechecked after a change in any pot. Determine the actual operating temperature at the R7161 terminals, using a standard thermometer after the temperature has stabilized with power on for 20 minutes. See fig. 2 and 3 for pot location.

AMBIENT TEMPERATURE COMPENSATION ADJUSTMENT:

1. Ambient temperature should be approximately 80 F.
2. Energize line voltage supply to R7161C.
3. Measure the millivoltage drop across range card resistor, second from left on range card. Top of resistor is (-), the bottom is (+).
4. Adjust potentiometer P1 to obtain correct reading as listed below.

Thermocouple Type	Correct Reading	Tolerance	Correction for deg. F from 80 F (mv/°F)
J	13.30 mv	± 0.40 mv	0.030
K	10.60 mv	± 0.40 mv	0.023
R	1.55 mv	± 0.15 mv	0.0065
S	1.55 mv	± 0.15 mv	0.0058

TO MAKE THE ZERO ADJUSTMENT (P2)—With Rubicon Type 2745 Portable Potentiometer (or equal) and Honeywell #117053 Test Cable. See also ALTERNATE METHOD:

NOTE: These adjustments must be made with the chassis in a case. They need not, however, be made in the case in which the chassis is housed during normal operation. If a spare case is not available, the chassis must be returned to the original case for calibration. Be sure that the thermocouple is disconnected if the test cable is not used.

1. De-energize the R7161.
2. Check mechanical zero of the meter and correct if necessary.
3. Plug the #117053 Test Cable into the test jack.
4. Connect the portable potentiometer to the test cable leads, plus (+) to the black lead and minus (-) to the red lead.
5. If the calibration is to be performed with the chassis in its original case, mount the new door and meter assembly on the case next. However, if calibration is to be done on a test bench in a spare case, do not fasten the door and meter assembly on the spare case, but stand it in its normal position on the front of the case. This position is essential for accurate calibration because of the magnetic effects of the meter.
6. Connect the meter leadwires to the meter of the new cover assembly, observing proper polarity of red leadwire to the (+) terminal.
7. Turn the control point potentiometer counterclockwise until the potentiometer reaches the end of its mechanical adjustment.
8. Energize the R7161, and apply a millivolt signal equivalent to 0 F with case temperature allowance.
9. Remove the hole plugs from the top of the case.
10. Wrap the shaft of an insulated handle screwdriver with a layer of insulating tape to eliminate ground during the calibration procedure.
11. Adjust the zero adjustment potentiometer (P2) (see Fig. 5) until the R7161 meter reads 0 F.

TO MAKE THE SPAN ADJUSTMENT (P3)—With Rubicon Type 2745 Portable Potentiometer (or equal) and Honeywell #117053 Test Cable. See also ALTERNATE METHOD:

1. With the R7161 still energized, apply a convenient millivolt signal to simulate a setpoint between 50 and 85% of full scale. (Include case temperature allowance.)
2. Depress the PUSH TO SET button and turn the setpoint knob to the exact chosen setting.
3. Release the PUSH TO SET button and adjust the span adjustment potentiometer until the meter indicates the exact setpoint.
4. Press the PUSH TO SET knob to verify that the identical position occurs with the knob alternately pushed in and released. If not, repeat steps 2 and 3.
5. De-energize the R7161 and remove the test cable and signal supply.

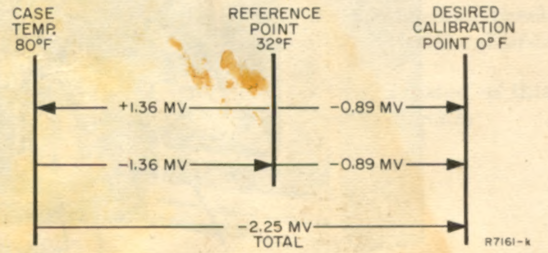
ALTERNATE METHOD FOR ZERO AND SPAN CALIBRATION

This procedure, although more difficult to set up, is very similar to factory methods and produces more accurate results than the previously outlined procedure. It differs mainly in the method of applying the simulated temperature signal. It is recommended that the entire preceding calibration procedure be read before using this alternate method.

1. Plug in Honeywell test cable #117053 and connect test circuit plus (+) to black and minus (-) to red, apply power to the R7161C chassis.
2. Temporarily attach a millivolt potentiometer with a null meter across the five ohm resistor in the test circuit. Set the pot for 0° F with case temperature allowance.
3. Adjust the variable resistances until the millivolt potentiometer shows null. This means that the voltage across the five ohm resistor is the same as the desired voltage. Disconnect the millivolt pot.

CASE TEMPERATURE ALLOWANCE

For standardization, tables of temperature-millivoltage equivalents use a reference point of 32 F (or 0 C). If a case temperature happened to be 32 F for a type J thermocouple, for instance, a signal of -0.89 mv would be equivalent to 0 F. But when the case temperature is different from the reference temperature, a second millivoltage must be added or subtracted to get to the reference point.



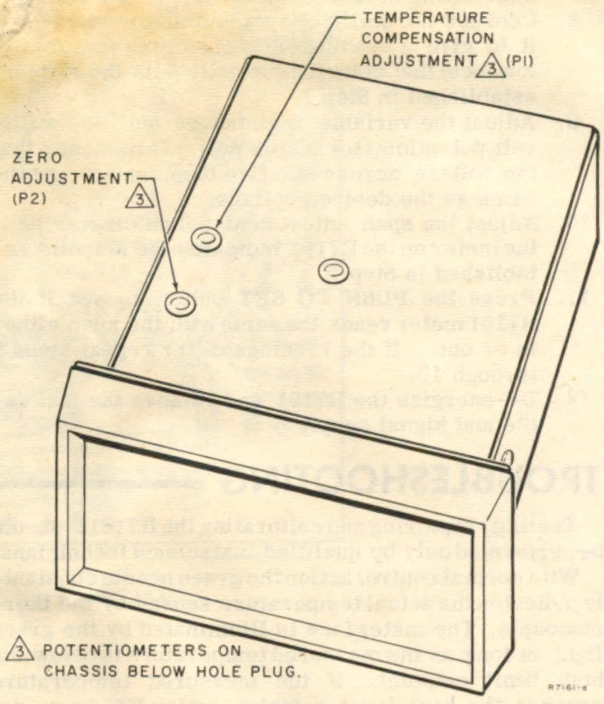


Fig. 2—Location of Access Holes for P1 and P2.

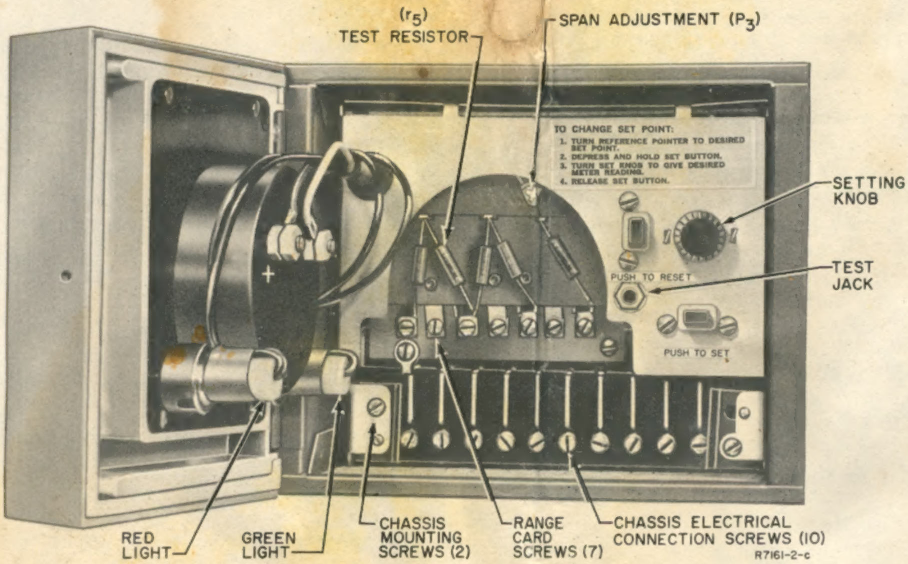
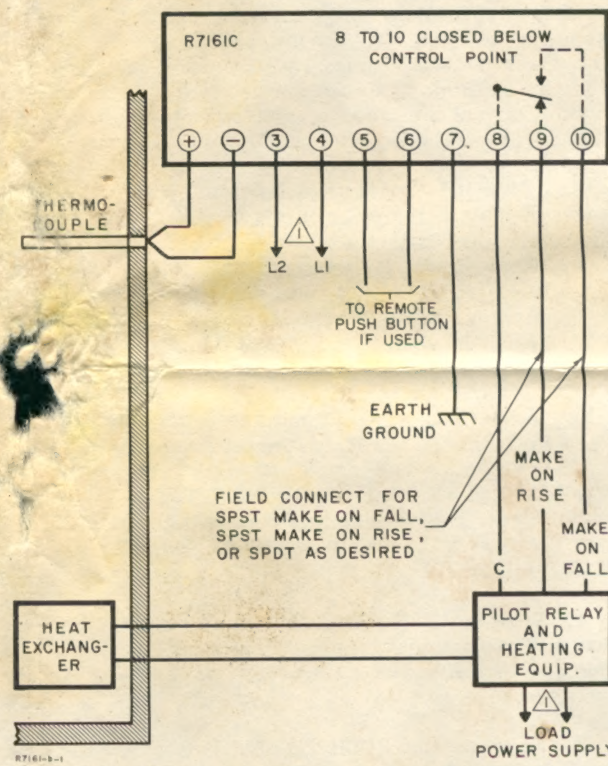


Fig. 3—View of R7161C With Door Open.

4. Turn knob of control point potentiometer counter-clockwise until the potentiometer reaches the end of its mechanical adjustment.
5. Remove the hole plugs from the top of the case. Wrap shaft of an insulated handle screwdriver with a layer of dielectric tape to eliminate grounding during the calibration procedure.
6. Adjust the zero adjustment potentiometer P2 until the R7161C meter reads 0° F.
7. Depress the PUSH TO SET button and turn the setpoint knob until the meter indicates a convenient setting between 50 and 85% of full scale.
8. Connect the millivolt potentiometer and adjust it to give a reading (with case temperature allowance) that coincides exactly with the setpoint established in Step 7.
9. Adjust the variable resistances until the millivolt potentiometer shows null. This means that the voltage across the five ohm resistor is the same as the desired voltage.
10. Adjust the span adjustment potentiometer until the meter on the R7161 indicates the setpoint established in Step 7.
11. Press the PUSH TO SET button to see if the R7161 meter reads the same with the knob either in or out. If the readings differ repeat steps 7 through 10.
12. De-energize the R7161 and remove the test cable and signal supply.



⚠ Power Supply. Provide disconnect means and overload protection as required.

Figure 4 — Typical Connections.

TROUBLESHOOTING

Testing, repairing and calibrating the R7161C should be performed only by qualified instrument technicians.

With normal control action the green needle constantly indicates the actual temperature sensed by the thermocouple. The meter face is illuminated by the green light as long as the measured temperature is below the high limit setpoint. If the measured temperature reaches the high limit setpoint, relay K1 drops out breaking the external load circuit through terminals 8-10 and closing the circuit through terminals 9-10. The meter face will now be illuminated by the red light which remains on until the device is manually reset even though the temperature should drop below the setpoint.

Deviations from the action described in the preceding paragraph, such as sluggish, erratic control or complete lack of control indicate trouble in the system.

A recommended trouble shooting procedure follows.

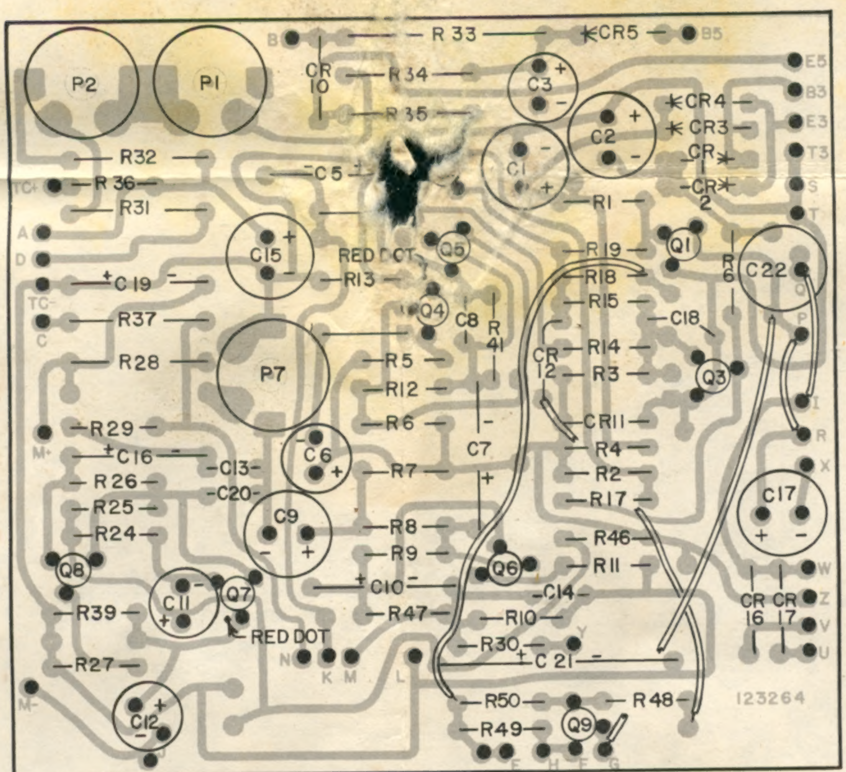
1. Check power supply voltages of the R7161C and of the load equipment.

2. Check for presence of line voltage at R7161C output switch terminals to determine if trouble is in the controller-sensor combination.
3. If trouble is in the controller-sensor combination check sensor first.
   a. If using mv input, verify with external precision source, such as listed under calibration.
   b. If a thermocouple sensor is being used a check for an open or shorted thermocouple may be made by plugging the test cable into the R7161C jack.

In the case of a shorted thermocouple the meter will read the ambient temperature of the instrument. If the test cable is plugged in with the shorted leads no change from a shorted thermocouple condition should result.

With an open thermocouple condition the meter will drive upscale and the relay will drop out. To check for an open thermocouple, plug in a shorted test cable. If the meter now reads the ambient temperature of the instrument instead of driving upscale, the trouble is very likely an open thermocouple.

4. If power supply, load equipment and sensor check out satisfactorily, recheck the R7161C calibration.
5. If source of trouble has not been located at this point, pull the chassis for bench checks.



R7161-ar

Fig. 5—Printed Circuit Board for the R7161C.

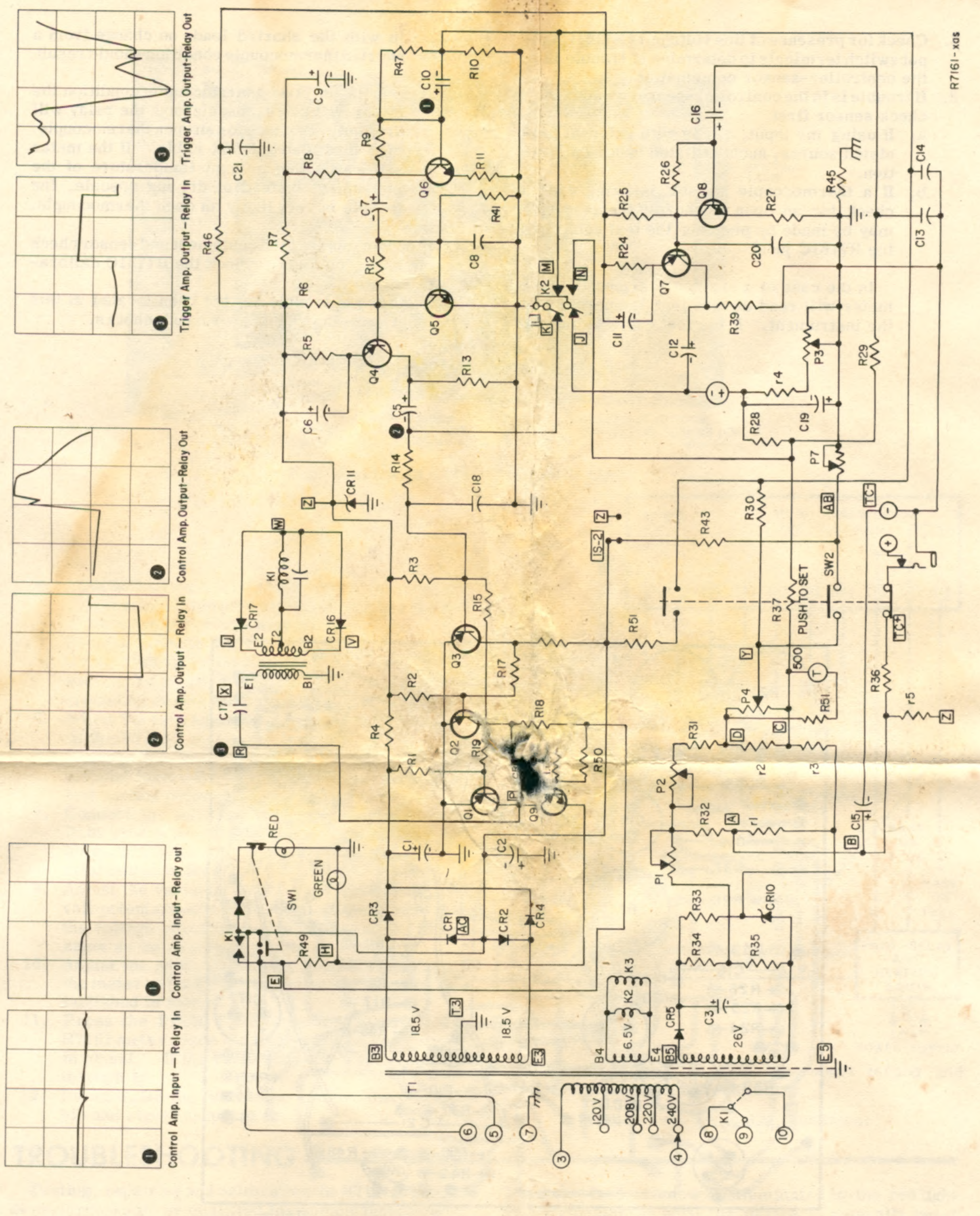


Fig. 6—Schematic Wiring Diagram for the R7161C.

PARTS LIST R7161C

R1	27K
R2	39K
R3	100K
R4	.62K^{o}
R5	1.8K
R6	3.3K
R7	4.7K
R8	4.7K
R9	470K^{o}
R10	22K
R11	56Ω
R12	330K^{o}
R13	1.5K
R14	1.8K
R15	68K^{o}
R16	3.3K
R17	15K
R18	1.8K
R19	1.8K
R24	3.3K
R25	3.3K
R26	470K^{o}
R27	39Ω
R28	10K*
R29	2.2K
R30	6.8K
R31	1K*
R32	2.21K*
R33	1.0K*
R34	11K*
R35	69.8Ω*
R36	.47 Ω
R39	2K
R41	47K^{o}
R43	2M
R45	470K^{o}
R46	1K
R47	20M
R48	1.0K
R49	5.6 Ω
R50	4.7K
R51	22M
R5	75 Ω^{o}

r1
r2
r3
r4
r5

See range card tabulation

C1	200 uf 30 v
C2	200 uf 30 v
C3	75 uf 50 v
C5	10 uf 25 v
C6	100 uf 25 v
C7	1 uf 12 v
C8	.47 uf
C9	350 uf 12 v
C10	25 uf 12 v
C11	250 uf 6 v
C12	100 uf 25 v
C13	.2 uf
C14	.2 uf
C15	750 uf 3 v
C16	25 uf 12 v
C17	200 uf 30 v
C18	.01 uf
C19	150 uf 3 v
C20	2 uf
C21	350 uf 12 v
Q1	2N1038
Q2	2N404
Q3	2N404A
Q4	2N217
Q5	2N2924
Q6	2N2924
Q7	2N2614
Q8	2N2924
Q9	2N697
CR1	1N645
CR2	1N645
CR3	1N645
CR4	1N645
CR5	1N645
CR10	1N752A
CR11	1N758A
CR12	1N759A
CR16	1N645
CR17	1N645

POT.	VALUE	FUNCTION	HONEYWELL PART NO.
P1	.3K	Temp. Comp. adj.	121220
P2	.3K	Zero adj.	121220
P3	200Ω	Meter Span adj.	121221
P4	20 Ω	Setpoint adj.	121212
P7	100Ω	Tolerance Comp. adj.	121221

T1	Transformer	#116399A
T2	Transformer	#116412A
K1	Load Relay	#113291H
K2	Chopper Relay	#126871

PC Board Assy.	#123264A
Cable Assy.	#121264B
Chassis Assy.	#125768AA